SPECIFICATION AMENDMENTS

Please replace the paragraph on page 6, lines 12-14 of the application with the following:

Fig. 9 is a schematic representation of the hydraulic circuit of a vane pump according to the present invention including a 3-way ~~variable target dual pilot~~ regulation valve and an anti-cavitation valve; and

Please replace the paragraph on page 7, lines 3-17 of the application with the following:

The housing 22 preferably comprises a central body 24 defining an internal chamber 26 in which the containment ring or eccentric ring 20 and rotor 12 are received. The housing 22 further includes a pair of end plates 28,30 on opposed, flat sides of the central body 24 to enclose the chamber 26. A groove 32 formed in an internal surface 34 of the central body 24 is constructed to receive a pivot pin 36 between the containment ring or eccentric ring 20 and housing 22 to permit and control pivotal movement of the containment ring or eccentric ring 20 relative to the housing 22. Spaced from the groove 32 and preferably at a generally diametrically opposed location, a seat surface 38 is provided in the central body 24. The seat surface 38 is engageable with the containment ring or eccentric ring 20 in at least certain positions of the containment ring or eccentric ring to provide a fluid tight seal between them. One or both of the containment ring or eccentric ring 20 and central body 24 may carry an

elastomeric or other type seal 40 that defines at least in part the seat surface ~~and reduces leakage between the containment ring or eccentric ring 20 and housing 22~~.

Please replace the paragraph on page 13, line 8 to page 14, line 15 of the application with the following:

Desirably, as best shown in Fig. 10, in accordance with a further aspect of the present invention, the axis 76 about which the containment ring or eccentric ring 20 is pivoted is located to provide an essentially linear movement of the containment ring or eccentric ring 20 between its first and second positions. To do so, the containment ring or eccentric ring 20 is pivoted about an axis 76 which is offset from the drive shaft axis 53 by one-half of the distance of travel in the direction of eccentricity of the containment ring or eccentric ring 20 between its first and second positions. In other words, the pivot axis 76 of the containment ring or eccentric ring 20 is offset from the drive shaft axis 53 by one-half of the maximum eccentricity of the containment ring or eccentric ring 20 relative to the drive shaft axis 53, and hence, relative to the rotor 12. The pivoting movement of the containment ring or eccentric ring 20 occurs along an at least somewhat arcuate path. By positioning the pivot axis 76 of the containment ring or eccentric ring 20 as described, the path of movement of the containment ring or eccentric ring 20 becomes essentially linear between its first and second positions. Non-linear or compound movement of the containment ring or eccentric ring 20 affects the gap or clearance between the rotor 12 and the containment ring or eccentric ring 20.

The performance and operating characteristics of the pump 10 are ~~determined~~ influenced by this gap or clearance. Accordingly, the non-linear movement of the containment ring or eccentric ring 20 when it is pivoted can vary the size of the fluid chambers throughout the pump 10, and importantly, in the area of the inlet 16 and outlet 18 of the pump. For example, the pumping chambers 70 may become slightly larger in volume as they approach the outlet 18 reducing the pressure of fluid therein and causing inefficient pressurization of the fluid at the discharge port. Desirably, offsetting the pivot axis 76 of the containment ring or eccentric ring 20 in accordance with this invention provides a movement of the containment ring or eccentric ring 20 which reduces such centrality errors and facilitates control of the pump operating characteristics to improve pump performance and efficiency. The arrangement of the invention also permits a more simple pump design with a center point of the containment ring or eccentric ring opening 41 moving along an essentially linear path. Further, the pump 10 should operate with less airborne or fluid borne noise.

Please replace the paragraph on page 16, lines 5-20 of the application with the following:

The spool portion 82 is generally cylindrical and is received in the bore 84 of a body, such as the pump housing 22. The spool portion 82 has a blind bore 132, is open at one end 134 and is closed at its other end 108. A first recess 136 in the exterior of the spool portion 82 leads to one or more passages ~~138~~ 139 which open into the blind

bore 132. The first recess 136 is selectively aligned with the third outlet 116 to permit the controlled volume of pressurized fluid, keeping the displacement high at the second actuator 72 (chamber 26a) to vent back through the spool portion 82 via the first recess 136, corresponding passages ~~138~~ 139, blind bore 132 and the first outlet 110 leading to the sump or reservoir 112. This reduces the volume and pressure of fluid at the second actuator 72 (chamber 26a). Likewise, the spool portion 82 has a second recess 140 which leads to corresponding passages 142 opening into the blind bore 132 and which is selectively alignable with the second outlet 114 to permit fluid controlled volume of pressurized fluid, keeping the displacement low at the first actuator 74 (chamber 26b) to vent back through the valve 80 via the second recess 140, corresponding passages 142, blind bore 132 and first outlet 110 to the sump or reservoir 112.

Please replace the paragraph on page 16, line 21 to page 17, line 16 of the application with the following:

The spool portion 82 also has a third recess 144 disposed between the first and second recesses 136, 140 and generally aligned with the second inlet 100. The third recess 144 has an axial length greater than the distance between the second inlet 100 and the second outlet 114 and greater than the distance between the second inlet 100 and the third outlet 116. Accordingly, when the spool portion 82 is sufficiently displaced toward the plunger portion 86, the third recess 144 communicates the second outlet 114 with the second inlet 100 to enable fluid at discharge pressure to flow through the

second outlet 114 from the second inlet 100. This increases the volume ~~of~~ and pressure ~~and~~ of fluid acting on the first actuator 74. Likewise, when the spool portion 82 is displaced sufficiently away from the plunger portion 86, the third recess 144 communicates the second inlet 100 with the third outlet 116 to permit fluid at pump discharge pressure to flow through the third outlet 116 from the second inlet 100. This increases volume ~~of~~ and pressure ~~and~~ of fluid acting on the second actuator 72. From the above it can be seen that displacement of the spool portion 82 controls venting of the displacement control chamber through the first and second recesses 136, 140, respectively, when they are aligned with the second and third outlets 114, 116, respectively. Displacement of the spool portion 82 also permits charging or increasing of the pilot pressure signals through the third recess 144 when it is aligned with the second and third outlets 114, 116, respectively.

Please replace the paragraph on page 18, line 9 to page 19, line 10 of the application with the following:

In response to these various forces provided by the springs 92, 94 and the fluid pressure signals acting on the plunger 90 and the spool portion 82, the spool portion 82 is moved to register desired recesses with desired inlet or outlet ports to control the flow of fluid to and from the first and second actuators 72, 74 (or chamber 26a/26b). More specifically, as viewed in Fig. 5, when the spool portion 82 is driven downwardly, the third recess 144 bridges the gap between the second inlet 100 and the third outlet 116

so that pressurized fluid discharged from the pump 10 is provided to the second actuator 72. This movement of the spool portion 82 preferably also aligns the second recess 140 with the second outlet 114 to vent the volume and pressure of fluid at the first actuator 74 to the sump or reservoir 112. Accordingly, the containment ring or eccentric ring 20 will be displaced by the second actuator 72 toward its first position increasing the displacement of the pump 10. The spool 82 operates with the bore 84 and outlets to behave as what is commonly known as a "4-way directional valve." As the spool portion 82 is driven upwardly, as viewed in Fig. 5, the third recess 144 will bridge the gap between the second inlet 100 and the second outlet 114 providing fluid at pump discharge pressure to the first actuator 74. This movement of the spool portion 82 preferably also aligns the first recess 136 with the third outlet 116 to vent the volume of and pressure of fluid at the second actuator 72 to the sump or reservoir 112. Accordingly, the containment ring or eccentric ring 20 will be moved toward its second position decreasing the displacement of the pump 10. In this manner, the relative controlled volume and pressures are controlled by two separate pressure signals which may be taken from two different portions of the fluid circuit. In the embodiment shown, a first pressure signal is the fluid discharged from the pump 10 and a second pressure signal is from a downstream fluid circuit source. In this manner, the efficiency and performance of the pump can be improved through more capable control.

Please replace the paragraph on page 19, line 11 to page 20, line 5 of the application with the following:

As best shown in Fig. 9, an inlet flow valve 150 in the fluid circuit may be provided to selectively permit fluid at pump discharge pressure to flow back into the pump inlet 16 when the pump 10 is operating at speeds wherein atmospheric pressure is insufficient to fill the inlet port 16 of the pump 10 with fluid. This reduces cavitation and ~~overcome~~ overcomes any restriction of fluid flow to the inlet 16 of the pump 10 or any lack of fluid potential energy. To accomplish this, the inlet flow valve 150 may be a spool type valve slidably received in a bore 152 of a body, such as the pump housing 22, so that it is in communication with the fluid discharged from the pump outlet 18. As shown, the fluid circuit comprises the pump 10, with the pump outlet 18 leading to an engine lubrication circuit 154 through a supply passage 156 which ~~passes through the~~ is connected to the bore 152 containing the inlet flow valve 150. Downstream of the engine lubrication circuit 154, fluid is returned to a reservoir 112 with a portion of such fluid routed through a pilot fluid passage 158 leading to the inlet flow valve 150 to provide a pilot pressure signal on the inlet flow valve 150, if desired. A spring 159 may also be provided to bias the inlet flow valve 150. From the reservoir, fluid is supplied through an inlet passage 160 to the inlet 16 of the fuel pump 10. The inlet passage 160 can pass through the bore 152 containing the inlet flow valve 150 and is separated from the supply passage 156 by a land 162 of the inlet flow valve 150 which provides an essentially fluid tight seal with the body.

Please replace the paragraph on page 20, lines 20-21 of the application with the following:

The purpose of the valve 150 and its supercharging effect is to convert available pressure energy ~~and convert it to~~ into velocity energy at the inlet to provide supercharging.